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Kingdom Arts and Sciences

April 2019

A Variety of Black Pigments



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Black seems like a simple color, but has a surprising amount of shades from blue black to a very dark brown. In medieval texts, the color is often glossed over with only a mention here or there of different ways of creating the color: charcoal, bone black, lamp black, and black earth. Infrequently a recipe explains how the black pigment was made. From these bits and pieces I have undertaken to explore the ways black was made and the differences in the end results. I excluded black earth in my experiments.

Tools and Materials

Charcoal and Bone Pigments:

- Fire pit
- 1 ¼" black pipe fitting with 2 end caps
- Mortar and pestle
- Palette knife
- Containers to hold pigment
- Maple logs
- Almond shells
- Peach pits
- Chicken, turkey, and pork rib bones
- Mammoth ivory

Lamp Black Pigment:

- Oil lamp
- Heat resistant glass dish
- Supports to hold heat resistant dish over the flame
- Palette knife
- Container to hold pigment
- Linseed oil, beeswax candle, and beef tallow candle

Making the Pigments

Charcoal

Charcoal can be made with a variety of carbon sources. I will address bone black separately from charcoal made from plant sources. Mentions of multiple sources of charcoal are listed in period sources made from things such as leather, hay, wood (except oak)¹, and elm bark². Most prized was that of grape vines. This black was referred to as tryginon by Pliny, and was also listed as atramentum³ and niger by other sources.⁴ De Arte Illuminandi describes the process as this:

First, and most generally, it is made very satisfactorily out of vine-twig charcoal, that is, by burning twigs of the vine from which wine comes; and before they turn to ashes, water is thrown on them, a little at a time, and they are allowed to go out, and the clean coals are separated from the ashes.⁵

¹ Manuscripts of Jehan Le Begue, Pg 138.

² De Arte Illuminandi, Pg 32, Note 37.

³ Manuscripts of Jehan Le Begue, Pg. 138.

⁴ De Arte Illuminandi, Pg. 32, Note 37.

⁵ De Arte Illuminandi, Pg. 2.

Cennini's instructions are very similar:

These [vine] twigs are to be burned; and when they are burnt, throw water on them, and quench them; and then work them up like the other black. And this is a color both black and lean; and it is one of the perfect colors which we employ.⁶

Other sources of plant material include peach pits and almond shells. The Marciana Manuscript mentions that charred peach stones make a "perfect black."⁷ Cennini refers to both burnt almond shells and peach stones as a "perfect black, and fine."⁸ The Paduan Manuscript says that burnt almond shells can make a black pigment.⁹ The Brussels Manuscript mentions not only peach stones, but also plum stones, and mentions that the fruit stones should be extinguished with vinegar to make a "most excellent black."¹⁰

I sought to create as many kinds of charcoal black pigments as I could. Since I was lacking grape vine twigs, I first took charcoal from burned maple and ground it. This was easy, quick, and cheap and produced a deep, opaque black when combined with gum arabic to create a paint.

I then saved and cleaned peach pits and almond shells to char them. So that the small peach pits and pieces of almond shells would not be lost in the fire and would not burn too quickly and turn white, I put the materials in a "crucible". Since the literature gives few hints as to how this black is made other than the source material, I searched online and found a mention of using a crucible covered in coals to char the material in the absence of air.¹¹ Cennini also mentions using a "casserole" to create a low oxygen environment to make charcoal sticks for writing¹². I looked into obtaining a period appropriate casserole to use to make my pigments. I learned that in order to put a clay vessel directly into a fire, the clay used would have to be a special flameware clay to prevent shattering in the fire. I was unwilling to spend the \$60-\$200 for a flameware casserole to make pigments.



Figure 1 "Crucible": a 1 1/4" pipe fitting with two end caps.

For my crucible I used a black pipe fitting with a cap on each end and loaded my material into this container. I then put the container into the fire for about an hour. I removed the pipe from the fire and allowed it to cool before emptying the contents. The peach pits and almond shells retained their original shape and texture, but decreased in size after charring.

⁶ Cennini, Pg 22.

⁷ Marciana Manuscript, Pg. 610.

⁸ Cennini, Pg. 22.

⁹ Paduan Manuscript, Pg. 650.

¹⁰ Brussels Manuscript, Pg. 820.

¹¹ Pigments Through the Ages, Bone Black, Making the Pigment.

¹² Cennini Pg. 19.

The almond shell ground differently than the charcoal. The feel of grinding the charcoal was slightly spongy, while the almond shells felt harder and wanted to shoot small pieces out of the mortar. The almond shell seemed to resist a fine grind and took more effort. When made into paint, the almond shell made a blue black that quickly shades to a pleasant grey.

Charred peach pits ground more easily than the almond shells. The resulting paint is a deep, rich black. I would agree with Cennini that is a most perfect black.

Bone Black

Bone black and ivory black are often combined in literature, ivory black being included in the name “bone black”. The Marciana Manuscript mentions ivory black specifically along with peach stones as substances that can be charred to make a “perfect black”.¹³



Figure 2 Mammoth ivory scraps



Figure 3 Ivory scraps in the crucible



Figure 4 The crucible is placed into a hot fire



Figure 5 Charred ivory scraps

I used the same crucible and method as I did with the peach pits and almond shells to char a variety of bones. I found that it is best to clean the bones as much as possible, boiling the fat and meat off if possible, but at least to dry them completely or mold will grow on the bones. The mold does not seem to affect the pigment. I started with chicken bones, then tried pork rib bones, and then turkey bones. I was gifted some mammoth ivory pieces and charred that using the same process.¹⁴

¹³ Maricana Manuscript, Pg. 610.

¹⁴ **A note on mammoth ivory:**

I used mammoth ivory due to many other ivories being rightly protected by CITES (Convention on International Trade in Endangered Species). Mammoth ivory is legal since the trade does not decrease the population of a species since mammoths are extinct. Some [estimate](#) that more than 10 million mammoths lie frozen in Siberia. These ivory tusks have begun to mineralize but are not fully fossilized.

The bones produced a wide variety of black pigments. Chicken and turkey bones produced a beautiful blue black, perhaps since the bones are thinner and were able to carbonize more completely. Pork ribs produced a brown black. Black pigment made from mammoth ivory made a brown black similar to that made from the pork rib. According to *Pigments Through the Ages*, ivory black pigment is high in calcium phosphate, making it the least pure form of carbon black.¹⁵ The high percentage of calcium phosphate must account for the brown color.



Figure 2 Charred chicken bones

Lamp Black

Lamp black is the soot primarily from a lamp or candle, but also chimney soot.¹⁶ The Paduan Manuscript mentions using both the smoke of nut oil and of burnt rosin.¹⁷ In different sources, lamp black is listed as atramentum, fuligo, fumus, fuscus, niger, sanctonicus, and sable.¹⁸ The process is essentially collecting the soot of a lamp or candle with a bowl or such held over a flame and then scraping the collected soot. *De Arte Illuminandi* describes the process like this:

Get a clean basin of brass or glazed earthenware, and put under it a lighted candle of clean wax, and have the flame almost reach the hollow of the basin; and carefully collect that black which is produced by the smoke. And put <the candle back again> and make as much of it as you want.¹⁹

Cennini describes a very similar process:

Take a lamp full of linseed oil, and fill the lamp with this oil, and light the lamp. Then put it, so lighted, underneath a good clean baking dish, and have the little flame of the lamp come about to the bottom of the dish, two or three fingers away, and the smoke which comes out of the flame will strike on the bottom of the dish, and condense in a mass. Wait a while; take the baking dish, and with some implement sweep this color, that is, this soot, off on to a paper, or into some dish; and it does not have to be worked up or ground, for it is a very fine color. Refill the lamp with the oil in this way several times, and put it back under the dish; and make as much of it in this way as you need.²⁰

¹⁵ *Pigments Through the Ages*, Bone Black, Overview.

¹⁶ *De Arte Illuminandi*, Pg. 33, Note 37.

¹⁷ Paduan Manuscript, Pg. 650.

¹⁸ *De Arte Illuminandi*, Pg. 33, Note 37.

¹⁹ *De Arte Illuminandi*, Pg. 2.

²⁰ Cennini, Pg. 22-23.

The Strasbourg Manuscript advises purifying the soot before using by putting lumps of brown soot into lye and boiling it to reduce it to a third. The liquid was then allowed to settle to allow impurities to settle to the bottom and the liquid above to be poured off, combined with gum arabic, and then used to shade paintings.²¹

Lamp black was the most challenging of the black pigments for me to create. I set a heat resistant glass dish over an oil lamp filled with linseed oil. I ensured that the top of the flame licked the glass dish and smoked sufficiently. The process of making lamp black pigment should be done in a place with little breeze, but with sufficient ventilation to allow the fumes to dissipate. The odor of burning linseed oil can be quite strong. Making lamp black pigment will undoubtedly leave small pieces of soot which are not easily cleaned up so the process should be conducted in a place that can get dirty.

At first I tried to use boiled linseed oil from a hardware store, but the amount of soot collected was frustratingly low. I then used linseed oil obtained from an art store which produced much more soot. I also tried to create soot from a beeswax candle and a beef tallow candle as mentioned in *De Arte Illuminandi*,²² but the candles did not produce any smoke or soot.

The process is more intensive than other black pigments. I had to keep an eye on the length of the wick and the position of the flame near the bottom of the dish. The wick kept burning down and I would have to adjust the wick to keep the flame at the right height. The amount of pigment that I collected seemed to be low for the amount of time and effort needed to make the pigment. When making paint with the lamp black pigment, I added a couple drops of ox gall in order to break the surface tension and allow the oily pigment to combine with water and gum arabic. My lamp black produced a more brown black than the commercial lamp black, probably due to the impurities found in the linseed oil. My pigment was still a lovely dark black. I did not purify my pigment using lye as described in the Strasbourg Manuscript because it sounds like the “lumps of brown soot” described are more like that deposited in a chimney and possibly with more impurities than linseed oil.



Figure 3 A heat resistant glass dish over a linseed oil lamp for making lamp black pigment.

²¹ Strasbourg Manuscript, Pg. 115.

²² De Arte Illuminandi, Pg. 1-2.

Next Steps

I have used the peach pit black pigment in my other Kingdom Arts and Sciences entry, but look forward to using the pigments in more illuminations. I have also found a couple of black pigment recipes that call for iron forge scale. A friend has gifted me some scale from her forge and I look forward to trying these recipes.

Conclusion

Overall, I was surprised by the variety of shades of black that I could create using period materials. I am impressed by the ingenuity of medieval scribes in turning waste materials into deep, rich pigments.

Sources

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Pigments Through the Ages, Bone Black, Making the Pigment.

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Appendix: Black Pigment Recipes Collected from Period Sources

Paduan Manuscript

Pg. 650

Black is made with the smoke of burnt nut oil, burnt almond shells, smoke of burnt rosin, and black earth.

Charcoal black

De Arte Illuminandi

Pg. 1

And all the other colors are artificial, namely; the black, which is made from the charcoal of vines or other kinds of wood, or from smoke of candles, wax, oil, or tallow, collected on a basin or a glazed porringer;

Pg. 2

Vine-twig charcoal

Burning twigs of the vine from which wine comes; and before they turn to ashes, water is thrown on them, a little at a time, and they are allowed to go out, and the clean coals are separated from the ashes.

Cennini

Pg. 19-20

How to Make Good and Perfect and Slender Coals for Drawing.

Before going any farther, I want to show you in what fashion you should make the coals for drawing. Take a nice, dry, willow stick; and make some little slips of it the length of the palm of your hand, and make some little slips of it the length of the palm of your hand, or, say, four fingers. Then divide these pieces like match sticks; and do them up like a bunch of matches. But first smooth them and sharpen them at each end, with a thin copper or iron wire. Then take a brand-new casserole, and put in enough of them to fill up the casserole. Then get a lid to cover it, <luting it> with clay, so that nothing can evaporate from it in any way. Then go to the baker's in the evening, after he has stopped work, and put this casserole into the oven; and let it stay there until morning; and see whether these coals are well roasted, and good and black. If you find that they are not roasted enough, you must put the casserole back into the oven for them to get roasted. How are you to tell whether they are all right? –Take one of these coals and draw on some plain or tinted paper, or on a gessoed panel or ancona. And if you find the charcoal takes, it is all right; and if it is roasted too much, it does not hold together in drawing, but breaks into many pieces. I will also give you another method for making these coals: take a little earthenware baking pan, covered as described above; put it under the fire in the evening, and cover this fire well with ashes; and go to bed. In the morning they will be roasted. And you may make big coals and little ones in the same way; and make them to suit yourself, for there are no better coals anywhere.

Pg. 22

Then there is a black which is made from vine twigs; these twigs are to be burned; and when they are burnt, throw water on them, and quench them; and then work them up like the other black. And this is a color both black and lean; and it is one of the perfect colors which we employ.

Lamp Black

De Arte Illuminandi

Pg. 2

Get a clean basin of brass or glazed earthenware, and put under it a lighted candle of clean wax and have the flame almost reach the hollow of the basin; and carefully collect that black which is produced by the smoke. And put <the candle back again> and make as much of it as you want.

Cennini

Pg. 22-23

There is another black which is made in this manner; take a lamp full of linseed oil, and fill the lamp with this oil, and light the lamp. Then put it, so lighted, underneath a good clean baking dish, and have the little flame of the lamp come about to the bottom of the dish, two or three fingers away, and the smoke which comes out of the flame will strike on the bottom of the dish, and condense in a mass. Wait a while; take the baking dish, and with some implement sweep this color, that is, this soot, off on to a paper, or into some dish; and it does not have to be worked up or ground, for it is a very fine color. Refill the lamp with the oil in this way several times, and put it back under the dish; and make as much of it in this way as you need.

Peach stone black or almond shell black.

A perfect black. Cennini pg 22

Brussels Manuscript- Merrifield

Pg. 820

The stones of peaches and plums burnt and extinguished in vinegar make a most excellent black.

Marciana Manuscript- Merrifield

Pg. 610

305. Black

Take peach stones and char them, or burn ivory, which will make perfect black, &c.